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ON THE PROBABLE AGE OF THE ALABAMA WHITE LIMESTONE.

BY THOMAS L. CASEY.

The Jackson stage of the marine Eocene may, and probably does, offer several lithological characters in common with the Vicksburg, but in the nature of its fossils it differs so profoundly that it is impossible to conceive of aught else than the lapse of a greatly prolonged time interval between the two horizons. Among some 240 species of the Jackson group I collected at Moody's Branch and at Montgomery, La., and the bluffs below, I am unable to recognize more than eight or ten which are unmistakably identical with any of a still larger series which I have found in the Vicksburg beds during a residence of nearly two years. It is true that there are quite a number of Vicksburg species so closely related to analogues of the Jacksonian as to conclusively indicate a direct descent from the latter, but many of these species belong to that class which, from the isolation of their environment, are peculiarly slow in evolutionary changes, such, for example, as *Dentalium* and *Cadulus* and some of the small bivalves, which from their frailness must live very secluded lives.

The fact which most distinctly proclaims the revolution of environmental conditions that must have been brought about during the interval in question, and the probably great lapse of intervening time, is that so many highly characteristic Eocene forms, such as *Venericardia planicosta, Verticordia eocense, Calyptraphorus, Pseudoliva, Capulus, Volutilithes, Papillina, Lapparia,* and other mollusks, besides a number of very characteristic Turbinolid corals, completely disappear and leave no descendant in any way related to them, for there are no species occurring in the Vicksburg strata which recall any of these forms. And again, there are many distinct types in the Vicksburgian, such as *Tritonopsis* and *Lyria costata,* the ancestry of which cannot be satisfactorily traced from the Jackson, and which must have required a long time for their evolution. In addition to these facts, there are several broad and striking differences between the two faunas, such, for example, as the great abundance of Bryozoa in the Jackson and the insignificant representation of this great class of animal life in the Vicksburg.

Because of the existence of most of these Eocene forms in the Red Bluff bed, I am inclined to consider that horizon more closely related to the Jackson than to the Vicksburg, in spite of the greater proportion of its species which have been identified with the Vicksburgian. It is possible, also, that many of these supposedly identical forms may prove to be more or less well marked subspecies, and not exactly the same as their Vicksburgian successors. However, not having visited the Red Bluff deposit as yet, it would be unreasonable to pass any definite opinion on this point.

If my memory serves, Mr. Vaughan informed me some time ago that he had found *Alveinus minutus* at Claiborne, Alabama. This species literally swarmed throughout the Jackson stage, and, in fact, is one of the most characteristic upper Eocene species, but no trace of it or of any allied species has occurred in either horizon at Vicksburg, even upon diligent special search on the part of the writer and careful washing of considerable quantities of marl from various parts of the beds. The discovery of a species of this genus in the Oligocene of Florida by Dr. Dall is therefore the more surprising.

As a broad statement, therefore, it may be said that the divergence of the Jackson and Vicksburg faunas is so radical as to abundantly justify the assignment of them to different epochs of the Tertiary—the Eocene and the Oligocene.

It is here necessary to discuss the distribution in time of the two species, *Orbitoides mantelli* and *Pecten poulsoni,* before alluding to the White Limestone of Alabama, for these two species seem to have been regarded, especially by Hilgard, as the conclusive earmarks of the Vicksburg formation. This is an error which has caused much misapprehension, for there is abundant testimony to prove that they both persist through such an extended range in time as to deprive them of any such value.

As for *Orbitoidès mantelli,* I personally collected in two partial days at Moody's Branch, and a portion of a day at Montgomery, La., with subsequent washing of a little marl, seventeen specimens, some of which represented large and well-developed individuals. This species was therefore at least tolerably abundant throughout the Jackson stage, and was probably in existence long before.

At Vicksburg there are two distinct horizons, as recognized by Meyer,[1] but very inadequately and in part erroneously elucidated by Hilgard. The lower Vicksburgian consists of alternate thin strata of gray sands, sandy clays and variably, but usually loosely, compacted white or gray limestone. The upper consists of a much thinner bed of more or less red-brown marl, often indurated into nodular masses, or subindurated, and without trace of limestone, having rarely, however, thin layers of glauconitic sands and comminuted shells, in which entire specimens when found are generally much distorted by pressure.

The faunas of these two beds differ very markedly, and there are probably not one-half of the species of either common to the two. One of the chief points of distinction resides in the fact that *Orbitoides mantelli* is virtually altogether wanting in the lower or limestone bed and is abundant and fully developed in the upper or marl bed. As this species existed in Jacksonian times, however, it seems as though it must certainly occur in the lower Vicksburg limestone, but at any rate it is so rare that I have never observed a specimen. The incongruity, therefore, of calling the Vicksburg limestone an Orbitoidal limestone is sufficiently evident; possibly the error occurred by reason of the washing down into the ravines of some material from the upper marls. It is consequently certain, from the facts above mentioned, that *Orbitoides mantelli* and its varieties existed through a considerable portion of the entire duration of our early middle Tertiary, including and subsequent to the Jackson stage, and that it became alternately abundant or semi-extinct according as surrounding conditions favored or retarded its development.

In regard to *Pecten poulsoni*, it is only necessary to refer to the report on the Coastal Plain of Alabama, by Dr. E. A. Smith, where, on page 237, this species will be found listed with the Bashi fossils of the Lignitic stage. As there is no more reason to doubt the correctness of this identification than there is to doubt the identity of the Vicksburg forms with the species in question, it will be readily perceived that *Pecten poulsoni*, because of its extended duration in time, is deprived of any decisive value as a criterion. Besides this, however, I find that there are at Vicksburg two well-defined subspecies, or perhaps closely allied distinct species, one characterizing the lower and the other the upper horizon, which have been indiscriminately alluded to as *poulsoni* for many years; it is quite possible that neither of them is exactly the same as that species, which was apparently described originally from the White Limestone itself.

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[1] The two lower horizons of Meyer constitute, in my opinion, but one.

On the Tombigbee river, near St. Stephens, and on the Alabama river, near Claiborne, there appear more or less conspicuous bluffs composed of a white limestone, which has been designated the Alabama White Limestone. The lower portion of the bluff at St. Stephens has been considered to be Jacksonian, while the upper part, which is apparently a conformable continuation, although differing noticeably in lithological character, has been identified as Vicksburgian, primarily because the limestone here becomes orbitoidal, and, secondarily, because it also contains a few fossils, especially *Pecten poulsoni*, which bear a strong resemblance to species occurring at Vicksburg. In accepting this as a fact we are forced to admit that two horizons, differing at least quite as radically in their fauna as any other two consecutive stages of the American Tertiary, are here conformably united in a continuous bluff of limestone. This would seem to be incongruous and highly improbable on general reasoning, but in my opinion it is not a correct statement of the case, and the above discussion of *Orbitoides* and *Pecten poulsoni* renders it quite unnecessary to form any such conclusion. It seems much more probable that the entire White Limestone of Alabama, including the coral limestone, is intermediate in age between the Claiborne and Jackson stages.[2] I feel the more confident in this statement on again consulting the report of Dr. Smith, where, on page 109, it is said that *Venericardia planicosta* was found by Mr. Aldrich in the upper part of the limestone near Claiborne, which is presumably the orbitoidal part, and this at once proves that it cannot at least be Vicksburgian. If this is not conclusive, however, it can be supplemented by another significant remark, made by Mr. Cunningham on page 254 of the same report, to the effect that the orbitoidal or upper portion of the White Limestone contains large numbers of "minute coralline branches." These are exceedingly abundant in the fauna of the Moody's Branch beds of the Jacksonian, and constitute one of its conspicuous features, but they are completely unknown from either the lower or upper horizons of the Vicksburgian.

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[2] The examples of *Orbitoides* contained in a specimen of the White Limestone from Clarke county, Ala., from the first bed above the Claiborne sand, which I have before me, differ very much from those occurring at either Jackson or Vicksburg in their much larger size; in fact they would almost appear to constitute a distinct species, and in any event they represent the maximum development of the genus in the Southern Tertiary. The Jackson and Vicksburg form is a degradational type derived from the White Limestone, and, as the White Limestone form is the one which was originally published under the name *mantelli*, it is the Vicksburg modifica-

It is probable that the uplift of the true Vicksburg beds was very limited in geographical extent, and confined to the vicinity of the capes or elbows of the coast separating, on both sides, the Bay of Mississippi from the ocean to the south, and that the so-called Vicksburg localities in eastern Mississippi are to be viewed with suspicion. It will require something more than *Dentalium mississippiense*, *Pecten poulsoni* and *Orbitoides mantelli* to prove them even approximately synchronous, as these classic species are all noticeably extended in vertical range.

Mr. D. W. Langdon enumerates[3] the fossils collected by him at Byram Station, on the Pearl river. They are all Vicksburgian with the exception of *Capulus americanus*, which is Jacksonian. As this species has never been found at Vicksburg, the presumption is that the Byram beds are older than the true Vicksburgian, and this is further borne out by the fact, which I have noted from personal observation, that the Byram deposit contains, besides the species quoted by Mr. Langdon, a considerable number peculiar to it and apparently occurring nowhere else. The evidence adduced by Mr. Langdon would seem to show that there is a notable thickness of marine, though scarcely fossiliferous, deposits between the true Jackson and Byram, and it is probable that during this interval the Red Bluff

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tion which must be considered to be undescribed. In the Lower Claiborne at Natchitoches, La., another form of *Orbitoides* occurs, which is smaller and thicker than that of Jackson and Vicksburg and probably specifically different.

[3] *Amer. Jour. Sci*, XXXI, p. 205.

beds were formed. The order of emergence of the various deposits—which were all more or less local—may therefore be stated to be: (1) Jackson stage, (2) Red Bluff substage, (3) Byram substage, and (4) Vicksburg stage. The *Scobinella cœlata* mentioned by Mr. Langdon among the Byram fossils, is not exactly the same as the form described from Vicksburg under that name, but is a very well-marked variety or subspecies, related, in fact, more closely to the form occurring at Red Bluff. The degenerative Vicksburg modification, strangely enough, appears to be entirely wanting in the lower—limestone—horizon, but is sufficiently common in the upper marls, as in the case of *Orbitoides mantelli* alluded to above.